

Integrating P2 into the Inspection Process

Dry Cleaning Industry – Perchloroethylene and Alternatives

Background

The dry cleaning industry sector is divided into three distinct types of operations: commercial, industrial, and coin-operated. According to the EPA, the commercial operations typically receive small quantities of clothing from individuals and are by far the most numerous with September 1995 figures at 30,494 facilities nationwide. Most commercial operations are single facility, “mom and pop” operations. There are about 1,379 industrial cleaners that typically clean uniforms and industrial clothing such as gloves. About 3,000 coin-operated cleaners offer dry cleaning services, some of which are self-service units.

The dry cleaning industry provides garment-cleaning services including pressing and finishing services. Dry cleaning is physically similar to home laundry, but the clothes are cleaned in specialized machines with a chemical solvent instead of water.

Traditionally dry cleaners have use perchloroethylene (PCE, or "perc"). Perc is a member of the chlorinated solvents family. There is increasing concern about the use of chlorinated compounds due to their persistence in the environment and their potential to bioaccumulate. There are no known, naturally occurring sources of perc in the environment.

Regulatory Issues

1991 EPA figures indicate 24,947 or 82% of the 30,494 commercial dry cleaners in the U.S. are perc cleaners. Perc consumed by the commercial dry cleaning sector totaled 122,700 metric tons (270 million pounds). Of this amount, about two-thirds, or 180 million pounds, is released annually into the atmosphere. Some of perc's breakdown components, such as vinyl chloride and phosgene, are toxic to humans; another, trichloroacetic acid, is a known herbicide that causes forest damage.

This industry has become heavily regulated due to the fact that perc has been readily released and is highly toxic to human health and the environment. In Kansas, dry cleaners of all size that use perc and even some perc alternatives are regulated through the Bureaus of Air, Remediation, and Waste.

Clean air regulations have been in effect for Kansas perc dry cleaners since September 1993, after EPA finalized the MACT, or maximum achievable control technology standards. MACT standards for petroleum dry cleaners are pending. The type of emission control technology required is based on the facility's annual solvent use and machine type.

Remediation regulations recently adopted implement the Kansas Dry Cleaner Response Act and supplement the existing hazardous waste regulations. These

regulations require facility registration, performance standards, use of surcharge funds for cleanup, and secondary containment for all perc machines and waste containers. Although illegal, perc is also discharged into sewer systems each year in the form of wastewater (from condenser water). Perc can migrate through concrete sewer pipes and also escape through sewer systems, which are designed to leak. Once in the soil, perc is mobile and can reach groundwater, where it remains fairly stable. Perc contamination of groundwater has been documented in many areas of the country.

Proper hazardous waste disposal for even small quantity generators for perc cleaners is required, as about 90 million pounds of perc-related emissions/wastes were captured in 1991 in the form of a solid waste, which is classified as hazardous under the Resource Conservation and Recovery Act (RCRA). Disposal of waste products containing perc must be handled by authorized facilities. These perc wastes are in the form of still bottoms and used perc filters, D039 listed wastes.

As regulations have been implemented, so has education for this sector. In 1999 and 2000, the SBEAP held dry cleaner workshops around the state. The compliance calendar was developed as well as fact sheets that address running total calculations and perc alternatives.

Where is the P2 potential?

Change the Process

P2 associated with perc involves the use of state-of-the-art equipment. Instead of using older machines that required the worker to transfer clothing from the perc wash unit to the perc dry unit, most cleaners now use dry-to-dry units that complete the entire cleaning and drying process in one machine. This prevents the release of perc to the environment when the machine door is opened and clothing is handled; it also decreases worker exposure to the chemical. Most perc machines have enclosed distillation units; this allows the perc to be cleaner in process and reused several times prior to disposal. Still bottoms and dirty disposable filters must be handled as hazardous waste.

Change the Material

Cleaners like to use perc because it dissolves oil and grease stains well and does not cause shrinkage like other cleaning processes. As concern has increased over the manufacture, use, and disposal of halogenated solvents and chlorinated chemicals, the search for alternatives and pollution prevention strategies has become more urgent. In an effort to reduce perc use, people in the garment care industry and environmental community have been experimenting with, analyzing, debating, and lobbying over alternatives including petroleum, wet cleaning, carbon dioxide, and other less hazardous methods that would replace the need for perc.

One of the most common perc alternatives in use today is thought to be petroleum. Although petroleum is a less toxic alternative to perc, it has some issues too. Perc cleaners say it does not clean as well; the clothing is left with an "off smell," besides the fact that most petroleum cleaners use a low flash solvent that increases the

shop's fire hazard. Benefits include the fact that the solvent is generally cheaper to buy and the waste is cheaper to dispose of.

But the oldest solvent, water, is becoming increasingly popular. In fact most dry cleaners around the country utilize some wet cleaning even if they use perc as their primary cleaner. The reason...less hazardous waste, less regulation, less liability, less expense, and better smelling clothes. Wet cleaning is very popular with the portion of the population that is chemically sensitive! In fact, many clothes such as wedding dresses, suedes and leathers come much cleaner in water!

Wet cleaning is done in specialized machines that use less agitation than a normal washing machine. Specialized detergents are often used. The wet cleaning machine consumes a great deal of water since that, rather than a chemical solvent, is the cleaning medium. Thus, the environmental impacts of using and treating water are much higher with wet cleaning than with dry cleaning. Further study is being done on recycling water, which can reduce wet cleaning's negative environmental impacts. Other studies include wastewater analysis for purposes of discharge to a POTW with strict pretreatment limits.

Uncertainties exist regarding the amount of labor required for wet cleaning. Because cost estimates are highly sensitive to assumptions about labor, this raises problems in analyzing the profitability of wet cleaning. To achieve the labor productivity required to compete with dry cleaning, the wet cleaner may need to invest in worker training, which is widely available.

Liquid carbon dioxide cleaning is the newest perc alternative being utilized. It uses liquid carbon dioxide and fluid jets under pressure to clean. Compared to perc it has reduced environmental liabilities but is said to be most economical for very large shops that run up to 24 hours a day.

Glycol ether known as *Rynex* is less toxic than perc but has received complaints related to the stale or "old medicine" smell left on clothes. It can be adopted for use in some newer perc machines and can be used to clean the same type of fabrics that are cleaned in perc.

A silicone-based solvent, such as *GreenEarth*, is clear and odorless. It is known to clean gently while keeping colors bright. Compared to perc, it has reduced environmental liabilities.

Change the Technology

The use of modern dry cleaning dry-to-dry units was discussed above in the change of process section. This type of machine upgrade may also be considered a change of technology as well. With machinery upgrades also come the use of refrigerated condenser and reusable filters.

Refrigerated condensers remove perc from the air stream contained within each dry cleaning unit. It is a vapor recovery system to which an air-perc gas vapor stream is routed and the perc is condensed by cooling the gas-vapor stream. Refrigerated condensers recover solvent emissions by chilling the air stream below the dew point,

causing the solvent and water vapor to condense. This technology can be added-on to machines that do not already have it. MACT standards require this technology on some machines.

Some units utilize spin disk or reusable filters. These filters allow for the disposal of waste perc sludge from the filters without having to dispose of the filter as well. This technology greatly reduces the volume and weight of hazardous waste disposed of.

Dry Cleaning Industry P2 Checklist

Keep machine doors closed at all times except when actively adding or removing clothes.

Open button traps and lint baskets only long enough to clean them.

Size garment loads correctly for the machine you are using, running loads at full capacity whenever possible.

Inspect and document dry cleaning equipment as required for obvious signs of leaks. Repair leaks within 24 hours.

Periodically replace old gaskets, seals, and valves.

Centrifuge and drain cartridges at least 24 hours prior to removal to allow excess solvent to drain back to machine for reuse.

Change solvent when it appears dirty, not necessarily on a schedule.

Have empty filter drums on hand so that spent cartridges can be put right into drums.

Label waste drums and keep a tight-fitting lid on the containers.

Never dispose of separator water (wastewater) through the sewer drains or outside. Use an approved method only.

Make a concerted effort to increase the percent of clothes that you wet clean instead of dry clean.

If new equipment is to be purchased, consider the following:

Replace perc systems with wet-cleaning technology.

Replace perc with other non-perc alternatives such as petroleum, CO₂, or glycol ether.

If perc machines are used, update machines so that only dry-to-dry technologies with refrigerated condensers and spin-disk filter systems are used. This will decrease the volume and weight of the hazardous waste generated.

Older dry-to-dry units should be retrofitted for refrigerated condensers whenever possible.

Provide training for employees that promotes waste reduction activities at your shop, everything from maintenance to wet-cleaning training.

Utilize the perc and petroleum cleaner compliance calendars for simplified environmental record keeping.

Establish a program to recycle hangers, plastic garment bags, cardboard rolls, metal cans or drums, and many other wastes.

Additional Resources

The Small Business Environmental Assistance Program, SBEAP, is a confidential non-regulatory program to assist small business with environmental concerns. Fact sheets and other detailed P2 and regulatory information can be obtained by contacting the SBEAP at 800-578-8898 or www.sbeap.org.

Center for Neighborhood Technology has a lot of information on perc alternatives, especially wet cleaning at: www.cnt.org

Regulatory compliance information can be viewed and downloaded from the KDHE Web site at www.kdhe.state.ks.us

EPA sector notebooks provide industry specifics and can be viewed at <http://es.epa.gov/oeca/sector/index.html>

Case Studies/Cost Benefit

Cottage Cleaners, Minnesota

Change: Replaced transfer machine with more efficient dry-to-dry machine
Cost: \$49,000 purchase cost of new dry-to-dry machine
Savings: \$2,246 per year for perc, reduced the amount of perc used from 455 gallons annually to 38 gallons annually.
\$593 per year for hazardous waste disposal; reduced generated hazardous waste total from 375 gallons annually to 240 gallons annually.

Lee's Cleaners, Wichita, Kansas

Three years ago Lee's Cleaners in Wichita purchased an Aquatex washing machine and dryer. Now, about half the clothes the company cleans are processed with water and the other half are cleaned with perc. Technicians at Lee's Cleaners prefer wet cleaning for suede and leathers, noting that those garments get much cleaner with water than with perc. They do have to do some stretching of the leather after cleaning. Men's suit jackets are also a problem in the aqueous machine because of the stretching required afterward. However, wet cleaning for slacks, wedding gowns, and fancy garments with beads or sequins are great. That's because perc causes swelling of fibers, which can weaken the attachment of beads or sequins.

Wet cleaning is not used on some fabrics, including ramie and 100 percent wool. She finds that wet cleaning works well for Dacron, silk, rayon, and polyester. Typically, however, lined items must be stretched.

Lee's wet-cleaning machine uses only cold water. Although wet-cleaning detergents can be expensive, Lee's uses two consumer detergents for some fabrics, and they work just as well. To avoid damage to delicate fabrics, garments are turned inside out and kept closed, using either the garment's fasteners (buttons or zipper) or safety pins. The outside of the fabric should not contact the rotating chamber of the washing machine.

The following are some advantages of wet cleaning: It is a bit quicker to get clothes into the washing machine because less spotting is required, and garments have a better scent when they come out. In fact, there is no residual odor because nonperfumed detergents are used. Customers of Lee's Cleaners who have asthma appreciate the lack of odor from wet-cleaned clothes. Another advantage is that multiple programming options are available with the Aquatex machine, allowing gentle cleaning.

Wet cleaning involves significantly fewer up-front capital expenditures than dry cleaning. For example, the cost of an Aqua Clean System washer and dryer is roughly \$30,000. In comparison, a similar-size dry cleaning machine costs roughly \$54,000. Costs associated with avoided hazardous waste disposal expenses and wet cleaning training should also be considered.